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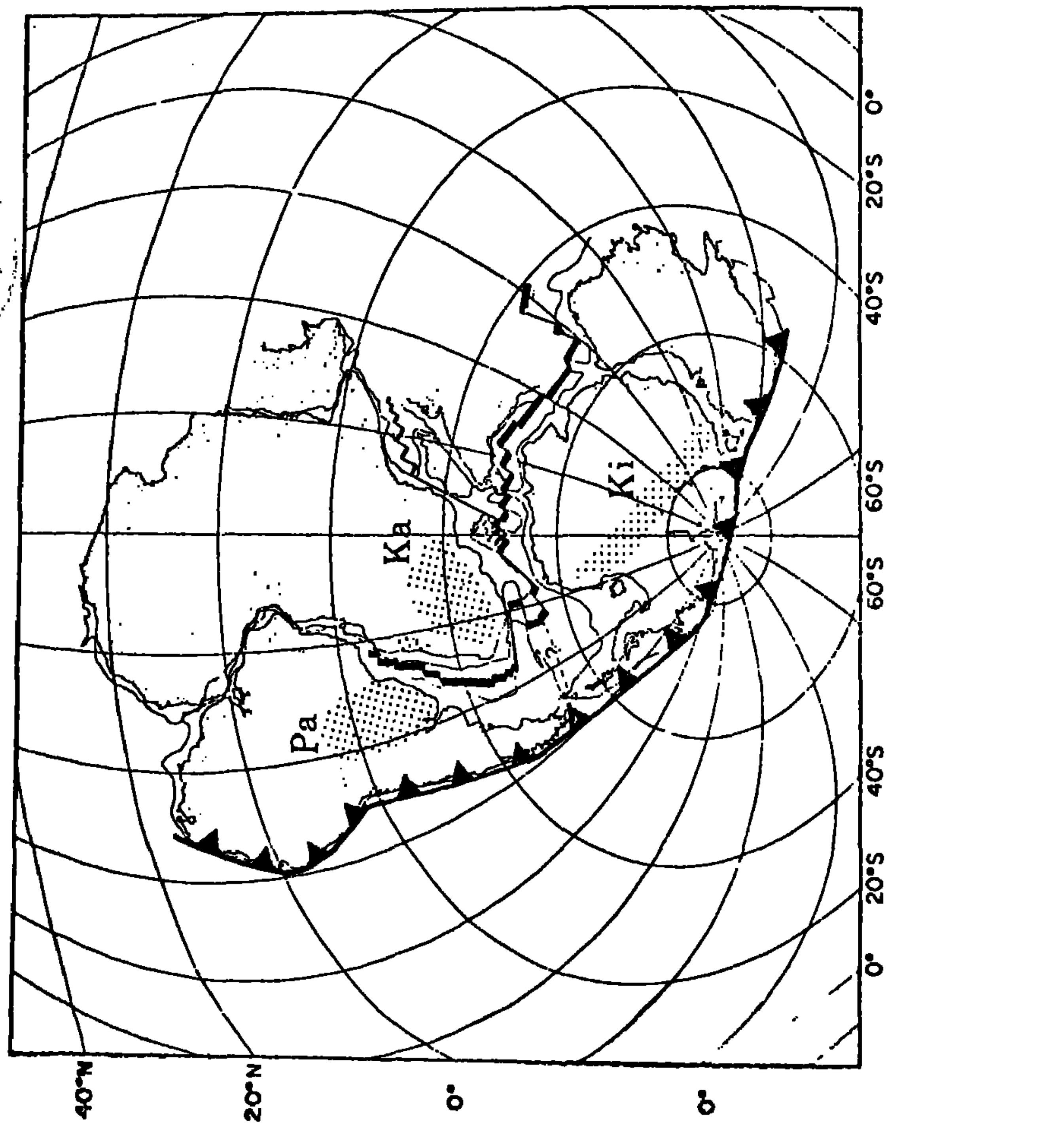

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Aeronomy

0410 Absorption and scattering of radiation (particles or waves)
STRATOSPHERIC OBSERVATIONS OF THE ATTENUATED SOLAR IRRADIANCE IN THE SCHUMANN-RUNGE BAND ABSORPTION REGION OF MOLECULAR OXYGEN
J. E. Frederick (Laboratory for Planetary Atmospheres, NASA/Goddard Space Flight Center, Greenbelt, MD 20771) R. D. Hudson and J. E. Mentall

A spectrometer flown on the first Solar Absorption Balloon Experiment (SABE-1) observed the attenuated solar irradiance between 184 and 202 nm from an altitude near 40 km. These measurements provide a check on the absorption cross-sections of molecular oxygen in the spectral region of the Schumann-Runge bands. Comparison of the measurements with calculations based on cross-sections derived from laboratory data shows a general agreement although the irradiance measurements have large error bars near the centers of the absorption bands. The results imply that the 184-200 nm solar irradiance which penetrates to the stratosphere can be computed to an accuracy of ±30 percent or better using presently available cross-sections. (Solar irradiance, absorption).
J. Geophys. Res., Green, Paper 1C1045

0499 General or miscellaneous
MEASUREMENT OF VOLT/METER VERTICAL ELECTRIC FIELDS IN THE MIDDLE ATMOSPHERE
R. C. Maynard (Laboratory for Extraterrestrial Physics, Goddard Space Flight Center, Greenbelt, MD 20771), C. L. Croskey, J. D. Mitchell and L. C. Hale (Ionosphere Research Laboratory, The Pennsylvania State University, University Park, PA 16802).

A test flight for a series of middle atmosphere electrodynamics rockets was launched from Wallops Island, Virginia, at 7:18 EST on July 31, 1980. The mother-daughter configuration contained a three axis symmetric double probe electric field instrument and a blunt probe on the daughter payload, and a Gerdien condenser and a single axis (vertical) asymmetric double probe electric field instrument on the mother payload. The payloads reached an apogee of 111 km, and data were gathered from all instruments on the downleg. A downward vertical electric field with a maximum amplitude of about 4 V/m was observed in a layer between about 57 and 67 km. The integrated potential across this layer was approximately 20 kV. Conductivity measurements indicated that free electrons were absent from the region of large electric fields; however, the decrease in conductivity was insufficient to maintain vertical current continuity through the layer. These results establish the existence of large mesospheric electric fields, supporting previous results from single axis measurements.
Geophys. Res. Lett., Paper 1L1136

Exploration Geophysics

0910 Computer applications
RECURSIVE REMOVAL AND ESTIMATION OF MINIMUM-PHASE WAVELET
See 0930 Seismic methods
N. Aftab Alam (Western Geophysical Company, 455 London Road, Isleworth, Middlesex, England) Charles J. Sicking

The Gram-Schmidt orthogonalization procedure is simplified under the assumption of stationarity and implemented to perform recursive predictive deconvolution. This process is called the orthonormal lattice filter. The results of deconvolution by this method are compared to the results of deconvolution using the maximum entropy and Levinson algorithms. The orthonormal lattice and maximum entropy algorithms are direct methods and estimate the filter from the data, while the Levinson algorithm is an indirect method and estimates the filter from the autocorrelation function. Results from synthetic and real data show that the direct methods have fewer windowing problems, higher resolving power, and are more suited for use in a time-varying manner than the indirect method. Results from real data show that optimally weighted space averaging and zero-phase band-pass filtering after time-varying direct deconvolution produces highly resolved and spatially coherent seismic sections.
GEOPHYSICS, vol. 46, no. 10

0990 Instruments
THE PHYSICAL FOUNDATION OF FORMATION LITHOLOGY LOGGING WITH GAMMA RAYS
See 5585 X rays, gamma rays, and cosmic rays
W. Bertozzi (Department of Physics, Massachusetts Institute of Technology, Cambridge, MA 02139) D. V. Ellis, and J. S. Wahl

We develop a theory for the gamma-ray spectrum in a scattering and absorbing medium. Expressions are derived for the spectrum when sources are uniformly distributed in an infinite medium. We express the view that the formation of the spectrum at a point is a local phenomenon, originating from the Compton degradation of high-energy photons which are transported from the source to the neighborhood of the point of interest. This allows one to apply the theory to a point source in an infinite medium, as well as to a geometry appropriate for well logging. Confirming evidence via Monte Carlo results and experiment is presented. We show an application to a well logging device for measurement of gamma-ray absorption via the photoelectric effect, a parameter which is sensitive to lithology.
GEOPHYSICS, vol. 46, no. 10

0999 General or miscellaneous
DELINEATION OF A LOW-VELOCITY BODY UNDER THE ROOSEVELT HOT SPRINGS GEOTHERMAL AREA, UTAH, USING TELESEISMIC P-WAVE DATA
See 6180 Thermal properties
See 8130 Heat flow
Russell Robinson (Geophysics Division, DSIR, Box 1320, Wellington, New Zealand) H. M. Iyer

To assess the nature of the heat source associated with the Roosevelt Hot Springs geothermal area, we have investigated the P-wave velocity structure of the crust and uppermost mantle in the vicinity of the Mineral Mountains, southwest Utah, a region of late Cenozoic rhyolitic and basaltic volcanic activity. A roughly square (30 X 30 km) array of 15 seismographs, centered on the mountains, was operated for a period of 46 days, during which 72 teleseismic events were recorded with sufficient quality for calculation of P-wave traveltime residuals. Relative residuals, using the array average for each event as reference, show a clear pattern of azimuthal variation of up to 0.3 sec. This pattern implies the existence of a localized region of relatively low-velocity material extending up from the upper mantle to depths of about 5 km under the Mineral Mountains. A three-dimensional (3-D) inversion of the data confirms this conclusion and yields a model featuring a region of low velocity (5 to 7 percent less than the surrounding rock) centered under the geothermal area and extending from about 5-km depth down into the uppermost mantle. The near-surface velocities obtained in the inversion clearly reveal the structure of the region, part of the Basin and Range province. An azimuthally changing pattern of wave-form distortion, restricted to the central Mineral Mountains, indicates the presence of a small but intensely anomalous region of low velocity and high attenuation at depths of about 15 km. Although we cannot rule out an explanation for the low velocity purely in terms of compositional changes, in view of the geothermal and volcanic manifestations found in the region we prefer an explanation in terms of abnormally high temperature and a small fraction of partial melt. A partial melt model implies a much greater heat reservoir than does a model involving only circulation along deep fault zones.
GEOPHYSICS, vol. 46, no. 10

ISEE 3 in Real Time: An Update

J. A. Joselyn, J. Hirman, and G. R. Heckman

NOAA/Space Environment Laboratory
Boulder, Colorado

In the October 9, 1979 issue of *Eos*, *Tsurutani and Baker* [1979] expressed the tangible benefits of obtaining selected interplanetary data from the ISEE 3 spacecraft in real time. As shown in Figure 1, reproduced from Tsurutani and Baker, ISEE 3 is positioned between the earth and the sun in a halo orbit about the sun-Earth libration point. This location is well suited to provide advanced warning of the onset of geomagnetic disturbances. Although the data were not originally intended for real-time use, NOAA and NASA began to cooperate early in 1979 to solve the technical and administrative problems requisite to acquiring the raw data before editing and transmission to the experimenters. In March 1980 the data stream began arriving at the Space Environment Services Center (SESC), Boulder, Colorado. Daily data coverage varies but averages near 80%. The data are now being routinely used to support SESC military and civilian customers and the scientific community at large.

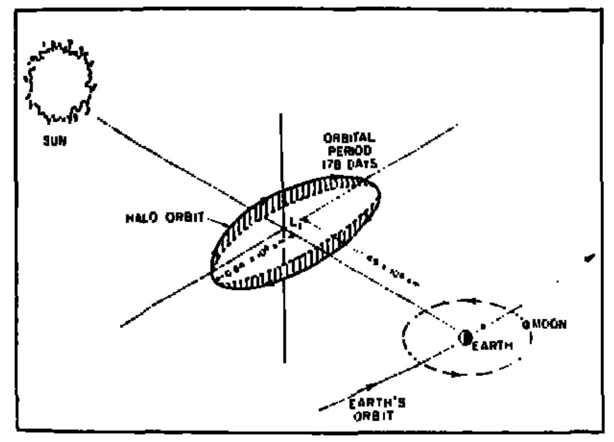

Fig. 1. The International Sun Earth Explorer 3 orbit about the sun-Earth libration point L_1.

SESC (a joint operation of NOAA and the Air Force Air Weather Service) is an around-the-clock center that closely monitors solar and geophysical conditions, issues warnings and alerts of special events, and writes twice-daily summaries and forecasts of the overall level of activity. Real-time and near-real-time data are routinely obtained from a chain of cooperating solar optical and radio observatories, including the remaining stations of the International Magnetospheric Study Program. Although interplanetary data have been provided in the past by Pioneers 6–9 and Vela spacecraft, and are now available by request from the principal investigators of Pioneers 6–9 and the Pioneer Venus Orbiter (depending upon a favorable location of Venus), ISEE 3 provides a vital platform for measuring ambient conditions in the solar wind some tens of minutes before Earth is impacted. In the past few months, this capability was especially helpful in providing support to NASA for the first flight of the shuttle *Columbia* and to the International European Energy Budget Campaign organized by D. Offerman.

Table 1 lists the experiments and the principal investigators who have released their data to NOAA specifically for real-time use. Additional details about the experiments are contained in a special issue of the *IEEE Transactions on Geoscience Electronics* [*IEEE*, 1978]. The raw data enter the SESC data base, SELDADS (Space Environment Laboratory Data Acquisition and Display System), via relay from NASA's Goddard Space Flight Center through NOAA's National Environmental Satellite Center. At SESC the data are processed, stored, and displayed in several formats. Beside appearing on continuous paper strip charts, the digital data are flashed on a monitoring screen that is updated to current values every 6 s. As the data are received and displayed, simple analysis is done to show the last clock time at which the interplanetary field turned southward plus a rough integration (gamma minutes) to help the forecaster evaluate how strong and persistent any southward field has been. The calculated velocity of the solar wind is used to show an estimated heliolongitude of the source of the solar wind, and there is an automatic shock detection message based on near-simultaneous increases of more than 50% in total magnetic field intensity and solar wind density and at least 50 km/s in velocity. The data residing in the SESC/SELDADS are available for printout and plots on variable time scales. In particular, the southward component of the interplanetary field can be displayed in two coordinate systems: solar ecliptic coordinates and solar magnetospheric coordinates. The algorithms for the latter transformation were provided by Roy Okida and Bruce Tsurutani of the Jet Propulsion Laboratory, California Institute of Technology.

At present the data are being used at three operational levels. On a routine level the ISEE 3 X ray detectors provide a valuable backup and extension of data received from NOAA/GOES satellites. Table 2 lists the energy ranges of the real-time ISEE 3 X ray channels and the NOAA/GOES channels. The intensity of the X ray flux at energies greater than 20 keV has been shown to be an indicator of the production of solar protons [*Lin and Hudson*, 1976]. The interplanetary plasma and magnetic field data provide valuable synoptic information. The general azimuthal direction of the magnetic field (e.g., toward or away from the sun) and the velocity are used in comparison with solar disc magnetograms from the Kitt Peak National Observatory to determine the large-scale source of the solar wind. Sector boundaries and other discontinuities in the direction of the solar wind are especially obvious. High-speed, low-density solar wind streams can be identified with specific coronal holes observed in helium 10830-Å spectroheliograms transmitted daily from Kitt Peak.

TABLE 1. ISEE 3 Data Acquired in Real Time

Experiment	Principal Investigator	Approximate Sampling Rate	1-min Data Base Values	Acquisition Date
Solar X rays	K. A. Anderson, Univ. of Calif.	120/min	Peak; average median	March 21, 1980
Interplanetary Magnetic Fields	E. J. Smith, JPL	360/min	Average median	March 21, 1980
Solar Wind Density, Velocity	S. J. Bame, Los Alamos Scientific Lab	1/1.5 min	Sampled value	March 15, 1981
Plasma Wave (3 kHz) Electric Fields	F. L. Scarf, TRW	120/min	Peak; average median	March 21, 1980

At an event-mode level, the ISEE 3 solar wind data can identify abrupt interfaces and shock waves in the solar wind. When these shocks impact the magnetosphere, they are seen at geosynchronous satellite and low-latitude ground-based geomagnetic observatories as sudden impulses in the horizontal component, which may be storm sudden commencements. Figure 2 illustrates a sequence of observations on July 17, 1980. The discontinuity in the total interplanetary magnetic field at ISEE 3 occurred at 1840 UT (solar wind density and velocity data were not available). Previous to the detection of this shock, we had noted enhanced noise in the 3-kHz plasma wave experiment. Those emissions are due to instabilities driven by energetic protons flowing upstream of the shock and are often seen to precede intervals of shocked or highly disturbed conditions in the solar wind [*Scarf*, 1977; *Kennel et al.*, 1981]. Fifty minutes later, at 1930 UT, the impulse was registered at the low-latitude IMS stations. The delay time for the distance from ISEE to Earth of 1.5×10^6 km implied an assumed constant shock velocity of 500 km/s and an extrapolated delay from the sun to Earth of 3.5 days. This travel time corresponds with the occurrence of an X1/1 bright flare on the sun on July 14 at 0830 UT. From March 21, 1980, through April 30, 1981, 30 apparent shocks at ISEE 3 have been identified with sudden impulses on the ground. Twenty-three impulses in the geomagnetic field occurred at times when ISEE 3 data were not available. However, not all shock signatures seen at ISEE 3 can be identified with magnetic impulses at Earth, and not all sudden impulses on the ground can be identified in ISEE 3 data. Many shocks cannot be readily associated with a specific flare or other solar event, such as a filament disappearance. Further, the details of the shock at ISEE 3 do not seem to correspond with the details of the impulse at the ground. This variety in the event data exemplifies the complexity of the solar wind and the interaction between the solar wind and the magnetosphere.

Finally, the ISEE 3 solar wind data are a potentially quantitative predictor of geomagnetic storms and substorms. The key to quantitative prediction is an understanding of the mechanism of energy coupling between the solar wind and the magnetosphere. Numerous algorithms relating solar wind parameters to geomagnetic indexes have been proposed. (For discussions, see *Crooker* [1975]; *Russell* [1980]; and *Donnelly* [1979].) We have presently implemented only two of these predictors. The first algorithm is *Arnoldy's* [1971] integration of the southward component of the interplanetary field. As explained above, this value is calculated as a simple summation of the magnitude of the southward field and is displayed in units of gamma minutes in real time. The integration is terminated during those times when ISEE data are not received or when B_z turns northward, restarting when the data resume. Although no permanent record of this parameter has been kept, it has proved to be of value as an indicator of the intensity of geomagnetic activity. Our experience is in accordance with the well-known result that predominately northward fields are associated with very little geomagnetic activity; fluctuating fields are associated with minor disturbances; consistently southward fields are associated with active conditions (K values at Boulder of 3, 4, and occasionally 5); and strong southward fields ($B_z \gtrsim -10\ \gamma$ and $\Sigma B_z t \gtrsim 1000\ \gamma$ min) are associated with storm levels. After a disturbed period, if the field turns and stays northward, magnetic activity diminishes.

TABLE 2. ISEE 3 and NOAA/GOES X ray Data

Data Channel	Energy Range
ISEE-3	
SC 1	12–20 keV
SC 2	20–36 keV
SC 3-4	36–52 keV
NOAA/GOES	
'long'	1.5–12 keV
'short'	3–24 keV

A second parameter presently calculated and displayed is 'epsilon,' a function first suggested by *Perreault and Akasofu* [1978] that is proportional to solar wind velocity and the square of the total interplanetary field and is strongly weighted toward southward fields. Detailed studies of this parameter relate it to *AE*, which is a global measure of geomagnetic activity substorms in the northern auroral zone. *AE* is not available in real time, even as an estimate, since SESC auroral zone observatories are concentrated in Alaska, with our easternmost data arriving as a summary report every 90 min from Upper Heyford, England. Nevertheless, epsilon performs as a reasonable estimator of geomagnetic activity in that values greater than the threshold of 10^{18} erg/s are associated with significant geomagnetic activity [*Akasofu*, 1980]. There are other functions of interplanetary parameters that have been suggested as predictor algorithms. Although most are intended to provide warnings on the order of tens of minutes (i.e., the travel time from ISEE 3 to Earth plus some additional lag time for substorms), some can offer predictions of up to hours. These include the 3-kHz plasma wave noise observations mentioned above and subtle density and velocity variations that may signal the approach of a stream interface region in the solar wind (*Gosling et al.* [1978]; R. L. Rosenberg, private communication, 1980).

In summary, SESC greatly appreciates the spirit of exploration and cooperation that led to the acquisition of the real-time interplanetary data from ISEE 3. We are using

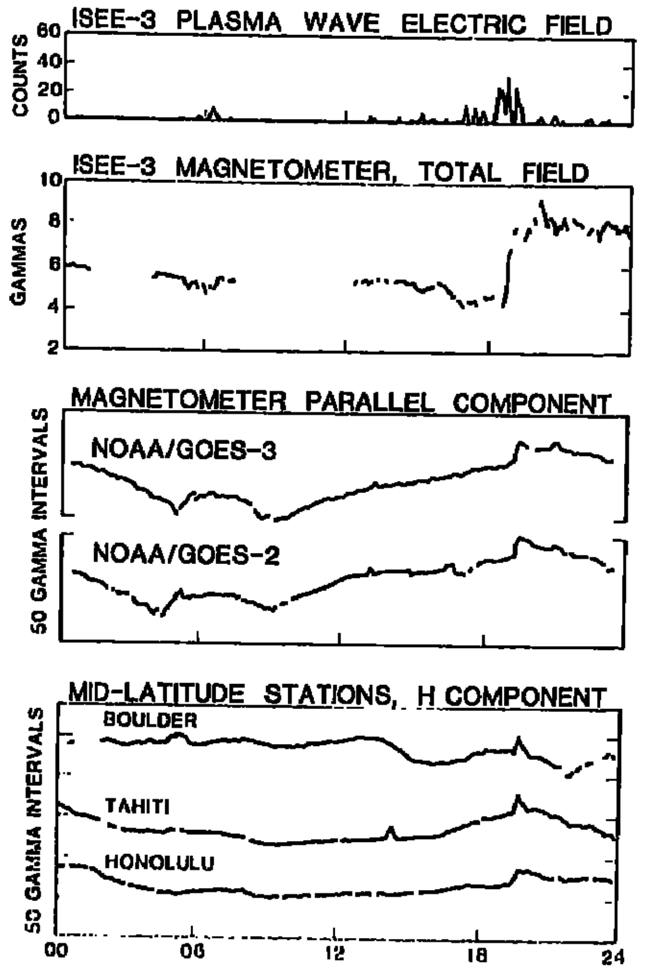

Fig. 2. A sequence of observations showing evidence of an interplanetary shock at ISEE 3 and then at Earth.

those data to support scientific research and provide warnings to commercial and military customers. The potential contained in the data is not yet fully realized, but we are implementing suggestions and algorithms to the best of our ability. For additional information about real-time data services, please contact the authors at the address given above.

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Cover. In the new AGU publication, 'Earthquake Prediction—An International Review,' K. Mogi describes the progress of the extensive Japanese program in earthquake prediction which began in 1965. As part of this program, observations of various geodetic, geophysical, and geochemical parameters are being made throughout Japan in order to monitor premonitory effects of earthquakes, including crustal deformation (a—strain and tilt meters, b—triangulation, c—leveling, e—tide gages) and seismicity (d—seismic stations of the Japan Meteorological Agency, f—microearthquake networks). See page 619 for details.

Acknowledgments

The ISEE 3 data stream and present state of analysis could not have been possible without the personal attention of the following individuals. Their assistance is gratefully acknowledged: C. E. Hornback and the entire staff of the NOAA/SEL Real Time Data Services, especially including R. Hines; J. D. Schroeder, III; L. Thomas; J. Abeyta; D. Wasmundt; and A. Gray; R. Wales and J. Spohr of NASA/GSFC Satellite Operations; B. Tsurutani, J. Wolf, and A. Frandsen of JPL; W. C. Feldman, R. Anderson, and E. Tech of LASL; P. Harvey, H. Primbsch, and S. Kane of the University of California; F. L. Scarf and W. Taylor of TRW; S.-I. Akasofu of the University of Alaska; and R. Donnelly of the NOAA/Space Environment Laboratory.

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News

Magnetic Monopole

The magnetic monopole, or magnetic point source (as opposed to the conventional concept of a north-south magnetic dipole), is again in the news, as it has been off and on for the past 50 years. Perhaps it is more precise to say that another episode in the continuing search for the elusive monopole is underway.

In a recent report by the National Science Foundation (*Mosaic, 12*, 1981, p. 19) it was stated of the monopole, 'If there is a dogma in modern physics, it might be that in nature anything not expressly forbidden to exist by a specific law must be presumed to exist. . . . Physicists are just going to have to get clever enough to find them.' In the eyes of the numerous investigators who have searched, monopoles are not just objects that exist by theoretical default, they are arcane, perhaps, but real.

In the lore of science fantasy, monopoles are like antigravitation machines in magnetic fields. The theory is that a monopole draws energy from and destroys magnetic fields. In a press interview held in Houston at a lunar science conference a few years ago, geophysicist Buford Price of the University of California (Berkeley), who was then and is now involved in the search for the monopole, made the alarming statement that a controlled monopole might make a good 'ray gun' for spacemen. The hard facts are that through the years Price and others have searched for the monopole as the 'missing link' in electrodynamic theory. Its existence would provide the essential balance needed for Maxwell's equation.

In 1931, Paul Dirac wrote a prediction theory for the magnetic quantum, the monopole. The theory was logical, but the monopole was elusive as it turned out. Investigators had no luck in their search for the monopole; it was to be 30 years before a significant effort was made. In the early 1960's, field men doing geology and geophysics research in the Adirondaks led a team of investigators through iron deposits as part of a new search of iron-bearing natural materials (minerals, rocks, meteorites). The idea was to attract any monopoles into a portable electromagnetic field and onto an emulsion detector. The monopoles, it was thought, would have lodged in the weak fields of an iron-rich material, after having been created in the upper atmosphere by collisions of atmospheric molecules with high-energy cosmic rays. The results were negative. With similarly negative results, millions of cubic centimeters of ocean water were tested at the Fermi Laboratory in Batavia, Illinois, and tests were conducted in the atmosphere with balloons.

Now the search has separated into two lines of pursuit: creating a monopole in the laboratory and searching in space. Buford Price and his coworkers are using the particle-track techniques, of which he was a coinventor, to detect monopoles that may have been created during particle annihilation experiments at SLAC (Stanford Linear Accelerator Center). The detectors are set up along the positron-electron ring at SLAC to make observations during particle collisions of several tens of billions of electron volts. The hope is that monopoles can be created in this energy range.

The search in space includes an examination of pulsars, and the effects that could have been caused by monopoles produced by high-energy collisions at a pulsar's surface. The appropriate polarity of monopole would drive into the parent pulsar, and being of sufficient number, would slow down the pulsar's rotation. The opposite polarity monopole would drive into space, and according to the processes, both north and south polarizations could accelerate into the cores of planets (once they made it into the galaxies).

According to theory, monopoles can be large, even immense. The mass equivalent per particle of the large ones could be on the order of 10^{25} eV. If entrapped in a planet's core, immense monopoles could effect the release of an appreciable amount of heat. What else they could do is in the realm of speculation.

The existence of the monopole is not required to explain magnetic or electromagnetic processes per se; they are necessary only to complete the symmetry of Maxwell's theory. There may be a range of sizes of the monopole, from the orderly size of 1 or 2 tens of electron volts to the gigantic. They may be hard to detect because conventional theory is inadequate to describe their properties. The search continues, nonetheless, and Price and others associated with the current experiments remain optimistic.—*PMB*

Peru Earthquake Prediction Update

Brian Brady of the U.S. Bureau of Mines has altered his prediction that three major earthquakes will rock Lima, Peru, this summer (*Eos*, March 31). He had predicted that a magnitude 7.5–8.0 event would occur on or about June 28, followed by a magnitude 9.2 event (Kanamori scale) on or about August 10, and a magnitude 9.9 event on or about September 16. No such earthquake occurred in June.

Without the occurrence of the first quake, the other two 'are very improbable,' Brady told *Eos*. He communicated the update in a personal letter to Alberto Giesecke, the retired head of the Peruvian Geophysical Institute. Brady said he has not made a substitute specific prediction. In January, the National Earthquake Prediction Evaluation Council rejected Brady's prediction, saying they were 'unconvinced of the scientific validity' of the forecast.—*BTR*

Senate Confirms Keyworth

The Senate confirmed George Keyworth on July 24 as the director of the Office of Science and Technology Policy. Keyworth, former leader of the physics division at the Los Alamos Scientific Laboratory, was recommended to the Senate following a hearing with the Commerce, Science, and Transportation Committee on July 20. The hearing was organized by the Subcommittee on Science, Technology, and Space, chaired by Senator Harrison (Jack) Schmitt (R-NM).

The confirmation follows by 2 months President Reagan's announcement of his intention to nominate Keyworth.—*BTR*

Gold Assures Methane

There is enough untapped hydrocarbon fuel to last Earth thousands of years says quasar astronomer Thomas Gold of Cornell University. He theorizes that these deposits of abiogenic methane are the results of the breakdown of hydrocarbons (trapped in the earth as it formed from solar nebula) under the high temperature and pressure that exists in the earth's interior. The carbon is thereby released in the form of methane gas (CH_4), which leaks to the surface continuously, through cracks and fissures in the crust. Gold's methane is not to be confused with the biogenic variety that has been discovered so far (i.e., 'natural gas').

The arguments for the hydrocarbons being in the earth's crust are based, in part, on the abundance of carbon-hydrogen compounds in space. Gold and his associate J. Soter, also of Cornell, have explained on numerous occasions how the hydrocarbon molecules associate in meteorites and, by analogy, in the earth. What has not been explained so far, is where these vast gas deposits are. Gold is arguing that they should be looked for at natural fault and joint systems. He feels that once proven, the deposits can be tapped and used as an energy source of almost indefinite proportions.

Recent reports (*Chemical & Engineering News*, July 13, 1981, p. 17ff.) of a study being done jointly by the California Institute of Technology and the Gulf Research and Development Co. on monitoring gas emissions along the San Andreas rift zone suggest that Gold's hypothesis may be tested. Not much funding for the project has been provided, but the study should supply useful data. So far no methane has been recorded along the rift (Gold says the San Andreas fault zone is 'too active,' i.e., that methane does not accumulate along it, but rather, escapes continuously at levels that may be detectable but probably are not commercially viable) but the project is only the beginning of a broader effort. Monitoring systems are in the development stage, and given time, it may be possible to test the theory in areas where biogenic methane could not occur. One such area suggested is the Canadian shield, which lacks sedimentary gas and petroleum deposits.

Many gas emission studies done in other areas have reported, on occasion, detecting methane. Geochemist Harmon Craig from the Scripps Institution of Oceanography has detected methane along the East Pacific Rise. Other locations include a site in Tibet where methane escapes regularly, Yellowstone National Park, and Lake Kivu, Africa. The occurrence of methane and other gases along vents forms a consistent picture. There is no evidence where the methane formed, however, and in no instance, so far, can it be demonstrated that the methane emissions are related to the mantle.

Methane can form easily by carbon-hydrogen reactions that are other than biogenic. To Gold, however, the ideas are still pretty much untested. He suggests isotope associations with other gases and geographic patterns that can be used to demonstrate a common mantle source for the methane. The study of gas emissions from fault zones is progressing based mostly on interest in the amount of ^{3}He that is released from the mantle. Gold's enthusiasm has led to the analysis of methane during the other studies. The results may support Gold's ideas, but the fear is that they may not be extensive enough. Some positive results from monitoring over the next year could provide Gold with the basis for obtaining more support.

Gold assures those who question his theory that the gas has to have formed, and he insists that the gas is trapped. Gold maintains these convictions amidst a growing consensus of controversy and doubt by many scientists and petroleum experts. Arguments have been voiced during inquiries by the Department of Energy and by the National Academy of Sciences. No one will say Gold is entirely wrong. However, few believe conditions in the mantle are favorable to trap vast quantities of methane, even given the astronomic theory. Oil companies have found no evidence, even in the deepest wells, but Gold's associate, Soter, says. '. . . I . . . think we need to take this hypothesis seriously because it could be so important if it is correct.'

Geophysicists

Donald L. Turcotte was appointed chairman of the Department of Geological Sciences at Cornell University. A member of the Cornell faculty since 1959, Turcotte moved from the mechanical and aerospace engineering department to geological sciences in 1973. He succeeds *Jack E. Oliver*, Irving Porter Church Professor of Engineering. Oliver is returning to teaching and research after serving as chairman for 10 years. Turcotte is president-elect of AGU's Tectonophysics Section and a member of AGU's Publications Committee.

Gerald J. Wasserburg was awarded the Arthur L. Day Prize by the National Academy of Sciences for his contributions to the physics of the earth. The $10,000 prize and lectureship is awarded approximately every 3 years. Wasserburg was honored at NAS' 118th annual meeting.

Laurel L. Wilkening, associate professor of planetary sciences at the University of Arizona at Tucson, has been appointed head of the department of planetary sciences and director of the University's Lunar and Planetary Laboratory. She succeeds *William B. Hubbard* who returned to teaching and research on planetary interiors.

New Publications

A Concise World Atlas of Geology and Mineral Deposits

D. R. Derry, John Wiley, New York, 110 pp., 1980, $61.95.

Reviewed by F. J. Sawkins

This atlas represents an overview of world geology and mineral deposits that can, as the author states, be 'understood by the layman and yet be useful to professional earth scientists.' Derry has produced an informative and well-written volume that essentially succeeds in that goal. It consists of an introductory orientation, an atlas with explanatory texts, and finally statistical data on national production and resources of the most important mineral and mineral fuel commodities.

The introductory section, which represents a brief review of physical geology, will mainly be of interest to those without any earth science background. It includes sections on landscape and geology, structure and history of the earth, distribution of earthquakes and volcanoes, life, and distribution of mineral resources. It is clearly intended to aid the nonprofessional to comprehend better the explanatory material that follows in the atlas. The final section on distribution of mineral resources would, I feel, have been considerably strengthened by the inclusion of sketches to illustrate the main types of metal deposits and the manner in which these and mineral fuel deposits are created. Such material would have aided all readers unfamiliar with economic geology.

The second section contains the real substance of the volume and consists of nine map sheets plus extensive explanatory text material. The maps, which cover all the land areas of the earth, are attractively colored and without undue complexity manage to convey a great deal of information on geology and resource distribution. The choice of scales and projections, although not uniform, is intelligent. The distribution of metal deposits is indicated by chemical symbols, but care is required here if the reader is not to gain a distorted impression of the relative importance of different areas in terms of their metal production. However, if the maps are used in close correlation with the text and national production and resource statistics in part three, this problem can be largely avoided. The most obvious example is the Antarctica map sheet that contains many symbols indicative of metal deposits that are at best no more than showings.

The text that accompanies each map sheet traces the geological development of each (map) area from earliest times to the present. Most major deposits are mentioned, but, here again some unevenness of emphasis creeps in. For example, no mention is made of the important base metal deposits of New Brunswick and Newfoundland. Despite this, and one or two errors in age designations of important deposits, a great deal of accurate and useful information is presented. Unfortunately, no attempt is made to differentiate the mineral deposits by type.

The world mineral production and reserves data contained in the third part of the volume are important. They serve to emphasize the highly uneven distribution of mineral and mineral fuel wealth amongst the various nations, and, as mentioned earlier, should be used closely with the maps. The final sections list sources of further information, both suggested readings and the addresses of national surveys around the world. A short glossary concludes the volume.

In conclusion, Derry has produced a valuable synthesis on the geology and mineral resources of the continents. This volume should be of particular use to geophysicists concerned about the resources of our planet.

F. J. Sawkins is with the Department of Geology and Geophysics, University of Minnesota.

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Engineer/Analyst. Engineer/analyst to provide support services and to engage in independent research in satellite instrumentation and mathematical modeling. Requires M.S. or equivalent in meteorology or meteorological engineering, knowledge of satellite and biometeorological instrument design, fabrication and calibration and radiative transfer algorithms on main frame computing systems. FORTRAN also required. Salary for 5 day, 40-hour week, 17,700 per year.

Contact Maryland Employment Security Administration, 6321 Greenbelt Rd. College Park, Maryland 20740.

Refer to Job Order #318365 by September 11, 1981.

Physical Scientist. GS-1301-11, Salary $22,486–$29,236. The Remote Sensing Branch of the Naval Ocean Research and Development Activity (NORDA) is seeking qualified applicants for the position of physical scientist. Duties include: Conducting research and development involving the acquisition, interpretation, presentation, and application of remotely sensed data to oceanographic problems and processing remote sensing data using interactive image analysis system (on advanced computerized system). Responding to Announcement No. 81-028, send a current SF-171 no later than 4 September 1981 to the Civilian Personnel Office (Code 140A), Naval Ocean Research and Development Activity, NSTL Station, MS 39529 or call 601-688-4640 for appropriate forms or additional information.

An equal opportunity employer. U.S. citizenship required.

Fellow in Mineral Physics. The Australian National University invites applications for appointment as fellow in mineral physics, Research School of Earth Sciences. An appointment is sought in the petrophysics group in the field of mineral physics, specifically in elastic and anelastic properties of rocks and minerals.

The successful applicant will be expected to be responsible for research in this area and in particular to develop high pressure, high temperature experimental studies relevant to the velocities and attenuation of seismic waves in rocks. Previous experience is essential.

The laboratory is well-equipped for work at ultrasonic frequencies and equipment is being built for seismic frequencies.

Appointment initially for 5 years with possibility after review to retiring age.

Salary $23104–$30952 p.a. Present exchange rates: $A1 = $US1.14. Reasonable travel expenses, assistance with housing, superannuation.

The University reserves the right not to make an appointment or to make an appointment by invitation at any time.

Applicants may obtain further particulars from The Registrar, Australian National University, PO Box 4, Canberra ACT 2600, Australia with whom applications close on 30 September 1981.

Hydrometeorologist, Assistant/Associate Professor level, tenure-leading. Develop and lead a research program to provide quantitative information on precipitation and evapotranspiration contributing to an understanding of the hydrologic balance of the Sandhills and other regions of Nebraska. Research program will involve cooperation with other meteorologists, hydrologists, ecologists, engineers and others involved in planning rational development of Nebraska's land and water resources. Requires Ph D. in meteorology or climatology with training and experience in hydrometeorology essential. Strong background in hydrology, instrumentation, mathematics and computer science desirable. Apply with letter and curriculum vitae by September 15 to: Norman J. Rosenberg, Director, Center for Agricultural Meteorology & Climatology, 202 C. Y. Thompson Library, University of Nebraska-Lincoln, Lincoln, Nebraska 68583-0728.

Affirmative action/equal opportunity employer.

Head, Department of Oceanography & Ocean Engineering. The Florida Institute of Technology seeks an individual to head a multidisciplinary department of scientists and engineers. Position to commence as early as September 1981. Candidates must possess a Ph.D. degree and have demonstrated meritorious scientific work in oceanography or ocean engineering with interest and experience in teaching, research, and administration. The Department has graduate and undergraduate interdisciplinary programs in biological, chemical, geological and physical oceanography, and ocean engineering. Curricula for the Ph.D. are available in physical, chemical, and biological oceanography. The department is part of a fast rising university in a community on the east coast thriving with technical industries. Benefits include free tuition for family members. Send resume and names of references to: Chairman of Search Committee, Department of Oceanography & Ocean Engineering, Florida Institute of Technology, Melbourne, FL 32901.

Florida Institute of Technology is an equal opportunity employer.

Senior Faculty Position: Meteorology. Applications and nominations are invited for a senior faculty position in meteorology, at the University of Utah. Eligible applicant will also be considered for chairperson of the department. Candidates must possess a Ph.D. in meteorology or a related discipline. Applicants should have teaching and research experience and be interested in participating in both the graduate and undergraduate programs. Applicants should submit curriculum vitae and names of three professional references to:

Dr. Jan Paegle
Search Committee
Department of Meteorology
University of Utah
Salt Lake City, Utah 84112

Deadline for applications November 30, 1981.

The University of Utah is an affirmative action/equal opportunity employer.

University of Hawaii/Faculty Positions. The Department of Geology and Geophysics and the Hawaii Institute of Geophysics have openings for the 1981–1982 academic year. Rank is open dependent on qualifications. We are seeking persons who will participate in our teaching and research program in any of the following areas: (1) structural geology and marine tectonics; (2) hydrology and engineering geology; (3) marine seismology, magnetics, and gravity. To apply send a letter of interest, a current vita and 3 letters of reference to Dr. S. O. Schlanger, Chairman, Department of Geology and Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822 (808-948-7826), or Dr. C. E. Helsley, Director, Hawaii Institute of Geophysics, same address (808-948-8760). Open until filled.

The University of Hawaii is an affirmative action and equal opportunity employer.

Professor of Space Physics. The Institute of Geophysics and Planetary Physics of UCLA invites applications for an academic ladder faculty position in the field of space physics The appointment is expected to be made at the level of professor. Applicants should have well established records in research in the area of fields and particles in space, and will be expected to conduct vigorous research programs in space plasma physics. Responses should include a resume of education, professional experience, and published research. Send replies to L. Knopoff, Associate Director, Institute of Geophysics & Planetary Physics, UCLA, Los Angeles, CA 90024.

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Research Faculty Position
University of Miami

Applications are invited for a nontenure research faculty position available in the Division of Meteorology and Physical Oceanography, School of Marine and Atmospheric Science, University of Miami The rank and salary will be negotiated depending on qualifications The applicant must hold a Ph D in atmospheric sciences, oceanography, or a related discipline Research programs in the Division include satellite oceanography and meteorology, extensive experimental physical oceanography projects and radar meteorology

Applicant should have interest in one or more of the following research areas boundary layer diffusion and transport processes including sea-air interaction, atmospheric or oceanographic modeling, experimental physical oceanography or meteorology including analysis of satellite observations

Applicants should submit curriculum vitae and the names of three professional references to the Search Committee Chairman, R. Lhermitte, School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, Florida 33149

The University of Miami is a private international university and is an equal opportunity/affirmative action employer

Atmospheric Scientist/Group Head. Senior staff scientist position available immediately at the NAIC's Arecibo Observatory. The successful applicant will be appointed as Head of the Atmospheric Sciences Group and will be expected to lead that group and to perform independent research using the Arecibo facilities A Ph D degree in atmospheric or physical sciences or radar engineering and a record of solid research accomplishments are required Experience with radar studies of the stratosphere, mesosphere, and ionosphere or with HF modifications of the ionosphere is desirable. Salary open. Please send resume and names of at least three references to Dr. Harold D. Craft, Jr., Acting Director, NAIC Observatory, Space Sciences Building, Cornell University, Ithaca, New York 14853.

NAIC/Cornell University are EOE/AAE.

Petroleum Geophysicist/New Zealand Geological Survey. New Zealand is undergoing major expansion of its energy resource investigations including prospecting for hydrocarbons. The Department of Scientific and Industrial Research, the principle Government R & D Agency, and advisor to government and industry in science and technology, has a vacancy in its Geological Survey for a seismic interpreter. The position, in the Petroleum and Basin Studies Section requires a person with a sound geological background primarily for regional analysis for the Basin Studies Programme.

Qualifications: A good 4 year bachelor's degree or higher, and at least 3 years petroleum exploration experience, are preferred.

Salary: A salary of up to NZ$23,520 per annum is offered for this position, depending on qualifications and experience.

Further information, application forms etc., may be obtained from the Ambassador Extraordinary and Plenipotentiary, New Zealand Embassy, Washington D.C. Applicants should quote Vacancy No. 2557 and forward applications, accompanied by a resume, to:

The Ambassador Extraordinary and Plenipotentiary
New Zealand Embassy
Observatory Circle, NW
Washington DC 20008
United States of America

Closing date for applications November 3, 1981.

Adjunct Professor of Geophysics. Applications are invited for an adjunct associate professor (research) position. Applicants should be interested and currently involved in the relations between marine geophysics and active continental tectonics. Applicant should have a Ph.D. in geophysics with broad experience in the collection of marine geophysical data and its interpretation, familiarity with land geology, particularly along active margins and experience in combining diverse marine and land data into large scale tectonic models. The appointee is expected to lead a vigorous research program. The adjunct position is non-tenure track. Salary range: $28,000–$31,000, equivalent to regular faculty positions with similar experience. Applicants should submit an application letter and resume to Mr. James Peters, California Employment Development Department, 297 West Hedding, San Jose, CA 95110, by September 30, 1981.

This advertisement was paid for by the employer.

Research Associate/Electron Microprobe. The Electron Microscopy Center at Texas A&M University invites application for the position of electron microprobe specialist. Applicants should possess a working knowledge of WDS and EDS spectrometers and accompanying computer and software programs and preferably have had experience in the geological sciences

The primary duties of the position are to oversee and maintain (with the aid of service contracts) the electron microprobe and ancillary equipment and to assist in teaching graduate course laboratories dealing specifically with electron microprobe analysis

Salary will be a maximum of $20,000/12 months.

Applicant should send supporting data and letter of recommendation to:

Dr. E. L. Thurston
Texas A&M University
Biological Sciences Building
College Station, Texas 77843

Texas A&M is an equal opportunity/affirmative action employer.

Postdoctoral Positions. Scripps Institution of Oceanography invites applications for three to five postdoctoral positions distributed among the following fields:

1. Inshore processes/coastal engineering.
2. Marine pollution and the assimilative capacity of the ocean for social wastes utilizing resonance ionization spectroscopic analytical methods
3. Climate research, including long-range weather forecasting and impacts of increased atmospheric carbon dioxide.

Private foundation funding limits awards to U.S. citizens. Appointments are for one or two years. Applicant should have a background in appropriate physical sciences for work in one of these fields at the Ph.D. level, or equivalent. Appointments in the University of California system will be at the level of Postgraduate Research or Assistant Research, salary from $17,112–28,400, commensurate with qualifications. Submit resume (specify position/field) including names of references, before *Sept. 18, 1981* to: J. D. Frautschy, Deputy Director, A-010, Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA 92093. Request position profiles at the same address.

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Oceanographer. GS-1360-12, Salary $26,951–$35,033. The Remote Sensing Branch of the Naval Ocean Research and Development Activity (NORDA) is seeking qualified applicants for the position of oceanographer. Duties include: Serving as principal investigator for planning and organizing basic and applied scientific investigations of radio probing of the ocean surface, and interpreting the results of these investigations in terms of oceanographic parameters. Specific areas of investigation will include the detection and analysis of ocean fronts and eddies through the use of satellite-borne altimeters. Responding to Announcement No. 81-027, send a current SF-171 no later than 4 September 1981 to the Civilian Personnel Office (Code 140A), Naval Ocean Research and Development Activity, NSTL Station, MS 39529 or call 601-688-4640 for appropriate forms or additional information.

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Research Associate in Geochemistry/University of Chicago. Post-doctoral position involving extraction of micro-samples from meteorites under clean conditions and analysis for major and trace elements by instrumental and radiochemical neutron activation. Goal is to investigate behavior of the elements during condensation of the solar system.

Experience in geological samples an asset, in meteorites a definite plus and in radiochemistry a necessity. Send vita and names of two referees to Professor Lawrence Grossman, Department of Geophysical Sciences and Enrico Fermi Institute, University of Chicago, Chicago, Illinois 60637.

The University of Chicago is an affirmative action/equal opportunity employer.

Position in Reflection Seismology/Rice University, Houston, Texas. The Department of Geology plans to expand its geophysical program. Emphasis will be on reflection seismology. At this time applications are for the first of two open faculty positions. The successful applicant will help in the search for and selection of the second faculty member.

Your main responsibility will be to lead our department into the area of modern reflection seismology. Your main teaching and research interests should be in the acquisition and processing of reflection seismic data. You should also help in developing rigorous undergraduate and graduate curricula, which are supported by the traditional strength of the Math Sciences, Physics, and Electrical Engineering Departments at Rice. Enthusiasm to work with and undertake some joint projects with our geologists is essential

Our plans are to acquire a computer system configured for high quality data processing Substantial seed money for this facility is already in hand. Creative cooperation with the oil and geophysical industry in Houston, including a reasonable amount of consulting, is encouraged. Salary will be commensurate with qualifications and experience. Please send your curriculum vitae, a summary of experience in seismic processing, a statement of research interests, and names of three or more references to Dr. A. W. Bally, Chairman, Department of Geology, Rice University, P.O. Box 1892, Houston, Texas 77001. Application deadline—October 1, 1981.

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Geophysicist. Faculty position for 12-month, tenure track appointment. A sea-going marine seismologist with interests in seismic reflection, refraction, or microseismicity is sought. Candidates with strong backgrounds in non-marine seismology or other branches of marine geophysics will also be considered. Duties include maintaining active research programs and obtaining outside funding, teaching graduate courses and supervising graduate students. Rank is Associate Professor. Applicants who meet all requirements, but have less experience than is normally required for Associate Professor rank, will be considered for appointment at the rank of Assistant Professor. Salary—$24,000 to $37,000, commensurate with experience. Send resume and names of three references by 1 October 1981 to G. Ross Heath, Dean, School of Oceanography, Oregon State University, Corvallis, OR 97331.

OSU is an affirmative action/equal opportunity employer.

Acoustical Physicist. Physics and Chemistry Department of Naval Postgraduate School (NPS), in Monterey, California, seeks applicants for tenure-track position at assistant or associate professor level, physicist who has experience and interest in teaching and research in area of acoustics. Primary mission of NPS is advanced education of Naval Officers. Department offers M.S. and Ph.D. degrees in Physics and Engineering Acoustics with major emphasis on Master's degree program. Most acoustics teaching is at senior and graduate level with concentration in underwater acoustics. Candidate must have Ph.D., be effective teacher and be interested in and capable of engaging in research. Current acoustics research areas: ocean acoustics including propagation, ambient noise, scattering and diffraction; propagation in tapered wave-guides; acoustic imaging; signal processing and non-linear acoustics. Send resume and references to Prof. O. B. Wilson, Department of Physics and Chemistry, Naval Postgraduate School, Monterey, CA 93940.

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Assistant/Associate Professor
Mackay School of Mines
University of Nevada-Reno

The Department of Geological Sciences invites applications for the tenure track academic year position of assistant or associate professor of Geology to teach undergraduate and graduate courses (M.S. and Ph.D.). We are seeking an outstanding person with potential for teaching, establishing new laboratories and conducting and supervising research in the Basin and Range and adjoining Provinces. Publishable research will be expected. Areas of expertise within geology which will receive favorable consideration are structural geology, sedimentology, stratigraphy and carbonate petrology.

The position will be filled in either January or August 1982, depending on the availability of candidates. The Ph.D. or equivalent degree is required. Salary and rank will depend on education and experience. Candidates should send a letter of application, list of publications, statement of teaching and research interests and transcripts and should arrange for at least three letters of reference to be sent to the Department. Closing date for application is November 15, 1981. Applications are to be sent to: Dr. L. C. Hsu, Chairman, Faculty Search Committee, Department of Geological Sciences, Mackay School of Mines, University of Nevada, Reno, NV 89557.

University of Nevada is EOE/AAE.

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STUDENT OPPORTUNITIES

Graduate Assistantships/SUNY. Graduate Assistantships are available in the areas of climatology, atmospheric chemistry and planetary atmospheres at the State University of New York at Stony Brook on Long Island. For information write to Professor Robert D. Cess, Laboratory for Planetary Atmospheres Research, SUNY at Stony Brook, New York 11794.

Research Assistantships in Meteorology. The Department of Meteorology at the University of Maryland has available research assistantships for graduate students. Beginning graduate student assistants are offered stipends of $8,195 which includes tuition and fees. Research topics cover atmospheric dynamics, general circulation, atmospheric radiation, numerical weather prediction, micrometeorology, satellite meteorology, climatology, synoptic meteorology, remote sensing, air pollution and cloud physics. Prospective students are encouraged to contact Dr. Ferdinand Baer, Chairman, Department of Meteorology, University of Maryland, College Park, MD 20742 (301-454-2709).

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In his November 4, 1980, *Eos* editorial, President Wilson challenged all members to sponsor at least one new member by the end of 1983 so that every member would be listed as a sponsor in *Eos* by then. Through June 30, 1981, 1219 members have been listed as sponsors. Those who have sponsored three or more new members are listed here.

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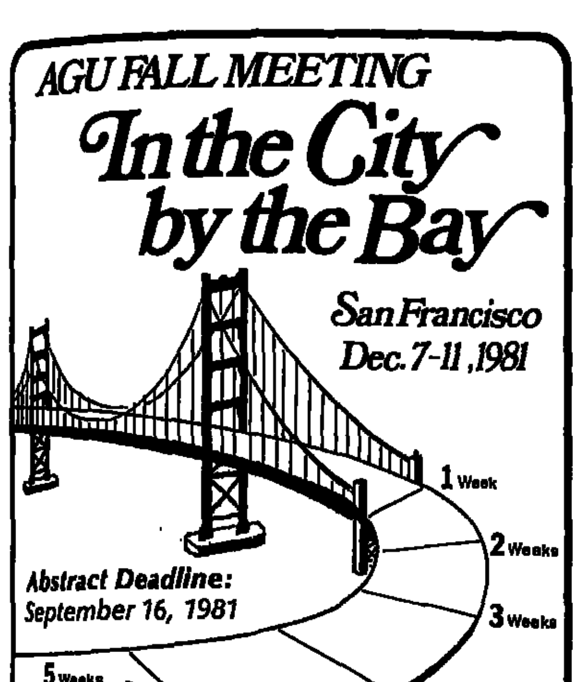
Meetings



New Listings

The complete Geophysical Year last appeared in the July 21 *Eos*.

Boldface type indicates meetings sponsored or cosponsored by AGU.

1981

Oct. 28–30 26th Annual Midwest Groundwater Conference, Bismarck, N. Dak. Sponsors, North Dakota State

1982

Jan. 24–29 **Conference on Origins of Plasmas and Electric Fields in the Magnetosphere,** Yosemite National Park, Calif. Sponsors, NASA, AGU. (F. T. Berkey, Center for Atmospheric and Space Sciences, Utah State University, UMC 34, Logan, UT 84322.)

Feb. 25–26 13th Annual Meeting of the International Erosion Control Association, Salt Lake City, Utah. (M. McMillan, Erosion Control Consultants, P.O. Box 195, Pinole, CA 94564.)

May 3–6 **Chapman Conference on the Discontinuities in Rock: Their Role and Significance in Geologic Processes,** Sante Fe, N. Mex. (Meetings, AGU, 2000 Florida Avenue, N.W., Washington, DC 20009.)

May 23–27 Second International Conference on Geological Information, Golden, Colo. Sponsors, Geoscience Information Society, Geological Information Group of the Geological Society of London, International Union of Geological Sciences, Association of Chief Librarians of National Geological Surveys, Association of Geoscientists for International Development. (D.C. Ward, International Conference on Geological Information, 223 Natural History Building, 1301 West Green Street, Urbana, IL 61801.

May 24–28 Joint International IEEE/APS Symposium, National Radio Science Meeting, and Nuclear Electromagnetic Pulse Meeting, Albuquerque, N. Mex. Sponsors, IEEE Antennas and Propagation Society, USNC/URSI Commissions, Permanent NEM Committee. (K. F. Casey, The Dikewood Corp., 1613 University Boulevard, N.E., Albuquerque, NM 87102.)

June 21–25 11th International Laser Radar Conference, Madison, Wis. Sponsor, Space Science and Engineering Center of the University of Wisconsin. (J. Edwards, Conference Coordinator, 11th International Laser Radar Conference, Space Science and Engineering Center, 1225 West Dayton Street, Madison, WI 53706.)

Aug. 16–18 International Conference on Coal-Fired Power Plants and the Aquatic Environment, Copenhagen, Denmark. Sponsors, International Association on Water Pollution Research, the International Union of Pure and Applied Chemistry, Nordic Cooperative Organization for Applied Research. (Dis Congress Service, Linde Alle 48, DK-2720 Copenhagen, Denmark.)

Aug. 25–27 23rd U.S. Symposium on Rock Mechanics, Berkeley, Calif. Sponsors, U.S. National Committee for Rock Mechanics, International Society for Rock Mechanics, University of California. (Organizing Committee, 23rd Rock Mechanics Symposium, c/o Richard E. Goodman, Department of Civil Engineering, 440 Davis Hall, University of California, Berkeley, CA 94720.)

Oct. 4–9 International Symposium on Polders of the World, Agora, Lelystad, The Netherlands. Sponsors, Department of Civil Engineering of the Delft University of Technology, Commission on Hydrological Research of the Netherlands Organization of Applied Scientific Research, the IJsselmeerpolders Development Authority, Society for Waterworks and Land Use Planning. (I. H. Wijkel, Information Centre 'New Land,' Oostvaardersdijk 01-13, 8242 PA Lelystad, the Netherlands.)

Oct. 18–21 GSA Annual Meeting, New Orleans, La. (J. M. Latulippe, Meetings Department, GSA, P.O. Box 9140, Boulder, CO 80301.)

1983

June 13–15 **International Symposium on Gas Transfer at Water Surfaces,** Ithaca, N.Y. Sponsors, Cornell University, AGU. (W. H. Brutsaert, School of Civil and Environmental Engineering, Cornell University, Hollister Hall, Ithaca, NY 14853.)

Oct 31–Nov. 3 GSA Annual Meeting, Indianapolis, Ind. (J. M. Latulippe, Meetings Department, GSA, P.O. Box 9140, Boulder, CO 80301.)

1984

July 21–28 Eighth World Conference on Earthquake Engineering. San Francisco, Calif. Sponsor, Earthquake Engineering Research Institute. (R. B. Matthiesen, Chair-8WCEE, EERI, 2620 Telegraph Avenue, Berkeley, CA 94704.)

1981 Midwest Meeting
Plan to Attend

September 17–18
Minneapolis, Minnesota

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- Hydrology in the mid-continental U.S.

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- Precambrian crustal evolution of the North American continent
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Electromagnetics

0110 Radio Oceanography
AN ANALYSIS OF SHORT PULSE AND DUAL FREQUENCY RADAR TECHNIQUES FOR MEASURING OCEAN WAVE SPECTRA FROM SATELLITES
Frederick C. Jackson (NASA Goddard Space Flight Center, Greenbelt, MD 20771)

A four-frequency moment characterization of backscatter from the near-vertical is applied to an analysis of the short pulse (SP) and dual frequency (DF) microwave techniques. It is found that (1) the range reflectivity modulation spectrum closely approximates the directional wave slope spectrum. Harmonic distortion is small and is a minimum near 10° incidence. (2) The SP measurement (signal-to-noise ratio) is typically 20-30 dB greater than the narrowband DF SNR. The difference in SNR is the ratio of the range beam width to pulse length, minus the ratio of beam-limited to pulse-limited Doppler spreads. It is concluded that narrowband DF measurements are basically impractical. To be practical, the DF technique must be "wideband". SP measurements on the other hand are found to be practical using existing space-qualified microwave hardware. Rad. Sci., Paper 1S0983

Exploration Geophysics

0910 Computer applications
DATA-ADAPTIVE POLARIZATION FILTERS FOR MULTICHANNEL GEOPHYSICAL DATA
J. C. Samson (Institute of Earth and Planetary Physics, Department of Physics, University of Alberta, Edmonton, Alta., Canada T6G 2J1) J. V. Olson

The design of data-adaptive filters requires that the noise be defined, statistically or otherwise, by parameters which allow some means of separating the noise from the signal. We consider here multichannel data in which one knows only that the noise is less polarized than the signal in a unitary space. This description of the noise is not sufficient for designing filters which are optimum in any sense; consequently, the filters may require a number of changes in the parameters before a satisfactory design can be found. Once this design has been achieved, the filters can be used to enhance waveforms of arbitrary shape, requiring little prior knowledge of the spectral content or temporal features of the signal. In contrast to many other data-adaptive filters which give a scalar time-series output, the filters we describe here with vector time series input have an equal number of input and output channels. A number of examples of filtered magnetic and seismic data are given in order to emphasize the wide range of uses for the filters. Some suggestions for application of the filters to multichannel seismic data are given. GEOPHYSICS, vol. 46, no. 10

0930 Seismic methods
A NOVEL APPROACH TO SEISMIC SIGNAL PROCESSING AND MODELING
See 0910 Computer applications
Jerry M. Mendel (Department of Electrical Engineering, University of Southern California, Los Angeles, CA 90007) John Kormylo, Fereydoun Aminzadeh, Ja Sung Lee, and Farroukh Habibi-Ashrafi

This paper demonstrates some results obtained using state-variable models and techniques on problems for which solutions either cannot be or are not easily obtained via more conventional input-output techniques. After a brief introduction to state-variable notions, the following seven problem areas are discussed: modeling seismic source wavelets, simultaneous deconvolution and correction for spherical divergence, simultaneous wavelet estimation and deconvolution, well log processing, design of recursive Wiener filters, Bremmer series decomposition of a seismogram (including suppression of multiples and vertical seismic profiling), and estimating reflection coefficients and traveltimes. GEOPHYSICS, vol. 46, no. 10

0930 Seismic methods
ESTIMATING ACOUSTIC ATTENUATION FROM A QUANTITATIVE SEISMIC PROFILER
See 6990 Instruments and techniques
Robert O. Tyce (Marine Physical Laboratory, Scripps Institution of Oceanography, University of California, San Diego, CA 92152)

Recent work has indicated that acoustic attenuation in marine sediments can be estimated from thin wedges of sediment by means of a quantitative seismic profiler. A capability for near-bottom seismic profiling at 4 kHz has been developed at the Scripps Institution of Oceanography Marine Physical Laboratory and utilized to determine effective attenuation for several areas of the sea floor. As part of the deep-tow instrumentation system of the Marine Physical Laboratory, this profiler provides very high lateral resolution. Real time computer displays of equivalent plane-wave pressure and intensity for seismic profiles have been developed as part of this system. These displays are produced on a standard graphic recorder and can be employed directly to determine effective attenuation by plotting displayed equivalent intensity as a function of depth of burial for a reflector covered by a wedge of sediment. For pelagic sediments, values of about 0.25 dB/m at kHz appear to be common. For the Southern California borderland, a wide range of sediment types is observed, with measured values of effective attenuation ranging from 0.21 to 0.61 dB/m. Highly calcareous (85 percent carbonate) sediments of the Carnegie ridge give quite low values, from 0.1 to 0.2 dB/m, with a suggestion of a rapid decrease in attenuation with depth. For non-biogenous sediments, values of effective attenuation appear useful for predicting other physical properties such as grain size and porosity, as well as general sediment type, from established interrelations. GEOPHYSICS, vol. 46, no. 10

0930 Seismic methods
DIP LIMITATIONS ON MIGRATED SECTIONS AS A FUNCTION OF LINE LENGTH AND RECORDING TIME
See 0910 Computer applications
Heloise Blossom Lynn (Formerly Department of Geophysics, Stanford University; presently Amoco Production Co., P.O. Box 3092, Houston, TX 77001) Suavel Deregowski

The length of a seismic profile and the recording time available as input to migration govern simple equations relating dip observable on migrated profiles to the spatial location of the reflector. This relationship is important to exploration geophysicists seeking critical seismic dip and to deep crustal geophysicists examining the nature of the continental crust. A certain amount of the observed decrease of dip with depth, and the dip biasing on the edges of migrated sections, can be related to the size of the input, as shown in a real data example. Any further decrease in dip with depth may have geologic significance. To portray (image) up to 45-degree dips at the target depth, 50 percent more time must be recorded and input to the migration as the two-way migrated time of the target. The lead-in (or step-in) required on both ends of the line is the depth to the target. For 0- to 30-degree dips to be present at the target depth, one-sixth more time must be recorded and input to the migration; the lead-in must be 65 percent of the depth to target. Crooked profiles complicate the migration: either linear segments of the profile are migrated separately (which drastically decreases the dip resolution obtained on the section as a whole), or the line can be "straightened" (projected onto a dip line) and then migrated as a unit (which assumes the target horizon is two-dimensional (2-D)). GEOPHYSICS, vol. 46, no. 10

0990 General or miscellaneous
AN EXPERIMENTAL TEST OF A LARGE-VOLUME PLASTIC DETECTOR FOR USE IN AERIAL GAMMA-RAY SPECTROSCOPY
See 3585 X-rays, gamma rays, and cosmic rays
Joseph S. Duval (U.S. Geological Survey, Box 25046, MS 964, Denver Federal Center, Denver, CO 80225) James A. Pitkin

A large-volume plastic detector for use in aerial gamma-ray spectroscopy has been evaluated by the U.S. Geological Survey. The purpose of the evaluation was to compare the plastic polyvinyl toluene (PVT) detector with thallium-activated sodium iodide [NaI(Tl)] detectors in ability to define the surface distribution of gamma radiation from the decay of natural thorium, uranium, and potassium. Good performance from PVT detectors will allow aerial gamma-ray detection to be less expensive and much less susceptible to physical or thermal shock compared to the use of NaI(Tl) detectors.

The experimental results indicate that PVT detectors can be used to measure the surface distribution of potassium (K), equivalent uranium (eU), and equivalent thorium (eTh). However, because of the relatively low-energy resolution of the PVT detector and the subsequent increased interference among the energy windows used to measure K, eU, and eTh, the results of data reduction are statistically less accurate than those obtained using NaI(Tl). GEOPHYSICS, vol. 46, no. 10

Geochemistry

1410 Chemistry of the atmosphere
CHEMISTRY WITHIN AQUEOUS ATMOSPHERIC AEROSOLS AND RAINDROPS
T E Graedel (Bell Laboratories, Murray Hill, NJ 07974) and C J Weschler

Hundreds of chemical compounds have been identified as constituents of atmospheric aerosols and raindrops, and there is substantial evidence for chemical transformations occurring among them. Since tropospheric aerosols have a water content of 10-50 weight percent at typical relative humidities, aerosols and raindrops may be regarded (at least to a first approximation) as aqueous solutions. In this review, atmospheric measurements and solution chemistry data are combined to examine reactions and physical parameters of potential importance to aerosol and raindrop systems; much of the information is potentially applicable as well to lake and ocean surface waters. Among the conclusions are the following:

(i) Solar radiation penetrates aqueous aerosols and raindrops, photodissociating several molecules and ions. H_2O_2, formed in the gas phase and dissolved in the aerosol, photodissociates to produce OH, which is thus a common constituent of aqueous atmospheric systems and appears to play a role in many chemical processes

(ii) The decomposition of atmospheric ozone dissolved in aqueous aerosols or raindrops is a second prolific source of HO_x radicals.

(iii) An analysis of the transition metal chemistry appropriate to these systems indicates that copper, manganese, and vanadium are potentially the most important homogeneous catalysts and that the concentrations of transition metals in aerosols are significant.

(iv) The oxidations of alkanes to alcohols, of alcohols to aldehydes, and of aldehydes to carboxylic acids result from chemical chains initiated by hydroxyl radicals or perhaps by organic photochemistry

(v) Rate parameters are available for many of the reactions of interest, particularly for the inorganic processes. Tabulations of relevant rate parameters, absorption coefficients, ionization constants, and aqueous solubilities are presented

(vi) The tropospheric aerosol can be viewed schematically as an aqueous solution surrounding an insoluble core and covered by an organic surface film of varying integrity, thickness, and composition.

Rev. Geophys. Space Phys., Paper 1R1068

Geomagnetism and Paleomagnetism

1510 Dynamo Theories
A SIMPLE PHYSICAL MODEL FOR THE TERRESTRIAL DYNAMO
Peter Olson (Earth & Planetary Sciences Dept., The Johns Hopkins Univ., Baltimore, MD 21218)

The strength of the earth's magnetic field results from an equilibration between rates of buoyant energy production and Ohmic dissipation. Changes in magnetic field, in particular the long term changes in dipole moment, provide an indication of changes in core energy sources, and so become critical data for understanding the evolution of both the core and deep mantle. A simple physical model is proposed to establish a connection between dipole moment behavior and production of buoyancy within the core. The model rests on two hypotheses: (1) magnetism is generated by small scale, rotation dominated turbulence consisting of a field of propagating inertial waves, and (2) the turbulence is supported by a flux of buoyancy, thermal or compositional, originating either at the core-mantle or inner core boundary. The efficiency with which wave kinetic energy is converted to magnetic energy is determined by the wave helicity – the correlation between velocity and vorticity. The wave heli-

Hydrology

Meteorology

3710 Boundary layer structure and processes
SIMULATION OF THE EFFECTS OF SURFACE FLUXES OF HEAT AND MOISTURE IN A MESO-SCALE NUMERICAL MODEL, PART I: SOIL LAYER
M.C. McCumber (Dept. of Environmental Sciences, Clark Hall, University of Virginia, Charlottesville, Virginia 22903) and R.A. Pielke.

A parameterization for bare soil is developed, which is to be incorporated in a mesoscale numerical prediction model. This parameterization is generalized to accomodate eleven types of soil in addition to peat, using mean soil characteristics.

The sensitivity of the scheme to several soil parameters is evaluated by a series of one-dimensional simulations. It is shown that the most important soil characteristic is the soil moisture, which regulates the strength of the heat fluxes between the atmosphere and the ground.
J. Geophys. Res., Green, Paper 1C1123

3715 Chemical composition and chemical interactions
MEASUREMENT OF HEAVY OZONE IN THE STRATOSPHERE
K. Mauersberger (School of Physics and Astronomy, University of Minnesota, Minneapolis, MN 55455)

The distribution of heavy ozone (molecular mass 50) has been measured for the first time in the stratosphere with a mass spectrometer system. During a balloon descent after midnight on Sept. 9, 1980, a pronounced enhancement of heavy ozone was found. The maximum in the isotopic ratio, $^{18}O^{16}O_2/^{16}O_3$, occurred at 32 km where the enhancement of heavy ozone was over 40%. The ratio decreased toward higher and lower altitudes, and reached the standard value below 24 km. These measurements confirm an earlier prediction that there exists a preferred production mechanism for heavy ozone in the stratosphere.
Geophys. Res. Lett., Paper 1L1079

3715 Chemical composition and chemical interactions
MEASUREMENTS OF CO AND CH_4 IN THE TROPOSPHERE OVER SAUDI ARABIA, INDIA AND THE ARABIAN SEA DURING THE 1979 INTERNATIONAL SUMMER MONSOON EXPERIMENT

happened to be overdense at 5.5 GHz. The 50 cm and the 111 cm radars produced strong echoes from every flash that we saw passing through the beams of the radars. Echoes were particularly strong on the radar with the longest pulse. Echoes received on radars that transmitted pulses 200 nanoseconds long consisted of short components. Some flashes reflected only one component but usually there were many more, and as many as thirty separate components have been counted. This paper supplies data relating to the mean values and to the dispersion of radar cross-sectional areas of lightning channels viewed by VHF radar.
J. Geophys. Res., Green, Paper 1C1108

Oceanography

4740 Marine geological processes
SEDIMENTARY PROCESSES IN THE GREAT LAKES
David K. Rea (Oceanography Program, Dept of Atmospheric and Oceanic Science, The University of Michigan, Ann Arbor, MI. 48109), Robert M. Owen and Phillip A. Meyers

Sediments in the Great Lakes are subject to four general categories of processes: input, transport, deposition and post-depositional alteration. Sedimentary input is from coastal erosion (64%), riverine input (26%), atmospheric transport (3%), and several lesser sources (7%). Once in the lake, sediments are transported to their place of deposition along the bottom and/or in suspension depending upon grain size and density. The rate of deposition in the Great Lakes is variable and ranges from nothing in some areas to over 6000 $g/m^2/y$ in the eastern basin of Lake Erie. After deposition sediments undergo bioturbation, dissolution of carbonate and opal, remobilization of many metals followed by reprecipitation within the surficial oxidized layer, and degradation of organic compounds.
Rev. Geophys. Space Phys., Paper 1R1109

4740 Marine geological processes
MARINE GEOLOGY OF THE HESS RISE PART I: BATHYMETRY, SURFACE SEDIMENT DISTRIBUTION, AND ENVIRONMENT OF DEPOSITION
E. Vallier (Hawaii Institute of Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, HI 96822) and L. W. Kroenke

4765 Surface waves, tides, and sea level
EFFECTS OF ISLANDS ON EQUATORIAL WAVES
J. H. Yoon (Geophysical Fluid Dynamics Program, Princeton University, Princeton, N.J. 08540)

4770 Turbulence and diffusion
VERTICAL TURBULENCE DIFFUSIVITY FOR WEAK OR STRONG STABLE STRATIFICATION
J. Weinstock (National Oceanic and Atmospheric Administration, Aeronomy Laboratory, Boulder, Colorado 80303)

was limited to strong stable stratification.
J. Geophys. Res., Green, Paper 1C1093

Geomagnetism and Aeronomy
Volume 20, Number 4

Brief Information

Particles and Fields—Interplanetary Space

5310 Cosmic Rays
COSMIC-RAY SCINTILLATIONS OBSERVED FROM SPACE
A. J. Owens (Bartol Research Foundation of The Franklin Institute, University of Delaware, Newark, Delaware 19711)

A theoretical calculation is given for the "scintillations" or fluctuations of cosmic rays expected to be observed during quiet times by a detector in interplanetary space or on the lunar surface. Interplanetary scintillations caused by fluctuations in the interplanetary magnetic field are not sufficient to explain the power spectrum recently reported by Benson et al. (1981) from a detector on the moon. Their inferred cosmic-ray fluctuations are considerably larger than observed during undisturbed periods by ground-based and satellite experiments.
Geophys. Res. Lett., Paper 1L1081

5310 Cosmic rays
ON THE ORIGIN OF THE MeV ENERGY NUCLEON FLUX ASSOCIATED WITH CIRS
S. P. Christon (Enrico Fermi Institute and Department of Physics, the University of Chicago, Chicago, Illinois)

Measurements of recurrent enhancements of interplanetary nucleon flux in the MeV energy range, detected at widely separated points in the heliosphere by charged particle instruments on board the Pioneer 10 and 11, IMP 7 and 8 and Mariner 10 spacecraft, are presented and interpreted. These features recur at the solar rotation period in association with stream-stream plasma interaction regions corotating with the sun (CIRs) and are not directly produced by solar flaring activity. At distances from the sun r < 1 AU, the maximum intensities of the hydrogen (H) and helium (He) components in these flux enhancements increase with increasing r at the same rate, usually between 300 %/AU and 600 %/AU. The nucleon abundance ratio, H/He, and the slopes of H and He differential energy spectra are relatively constant with r. One of the models proposed to explain these enhanced fluxes predicts the acceleration of nuclei from keV

5360 Solar wind interaction with moon and planets
A SOURCE OF PLASMA TURBULENCE AT THE IONOPAUSE OF VENUS

5380 Solar wind plasma
INTERPLANETARY ALFVENIC FLUCTUATIONS: A STOCHASTIC MODEL

Particles and Fields—Ionosphere

Particles and Fields—Magnetosphere

tional motion of plasma, owing to asymmetry in configuration of the magnetosphere, is also likely to produce energy dissipation of a similar magnitude as the rotational speed is adjusted continually. Thus the corotation enforcement current deposits as much heat as the dynamo current from Io and plays an important part in energetics and dynamics of the Jovian magnetosphere. The heating rate per unit area of the high-latitude ionosphere is more than ~10 erg/cm²-sec, namely, orders of magnitude greater than the rate of the energy supply by the solar UV radiation. These numbers depend on the adopted height-integrated conductivity of 0.1 mho of the Jovian ionosphere. (Jupiter, magnetosphere, ionosphere, heating.)
J. Geophys. Res., Blue, Paper 1A1037

5760 Plasma motion, convection, or circulation
DIFFUSION OF COLD MAGNETOSPHERIC IONS
T. J. Birmingham (NASA/Goddard Space Flight Center, Laboratory for Extraterrestrial Physics, Greenbelt, Maryland 20771) T. G. Northrop

We investigate conditions under which a diffusion equation is a valid description of the transport across magnetic field lines of low energy magnetospheric plasma. In this paper we consider the case where the guiding center drift $u_E = cE \times B/B^2$, and in particular its fluctuating component δu_E, are comparable in size to the particle thermal speed. We conclude that a two dimensional diffusion equation is valid in the α,β space of the Euler potentials provided that the curl of the total electric field component parallel to B vanishes $[\nabla \times (B \cdot E_1)B = 0]$ and provided the fluctuations have a short enough correlation time that guiding center drifts other than u_E remain negligible. Ions in Jupiter's Io plasma torus are thus described by a diffusion equation if this correlation time is no more than a few rotation periods of the planet.
J. Geophys. Res., Blue, Paper 1A1053

5790 Instruments and Techniques
THE CHARGING OF SPACECRAFT SURFACES
H. B. Garrett (Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91103)

The buildup of static charge on satellite surfaces is an important issue in the utilization of satellite systems. The analysis of this phenomenon has required important advances in basic charging theory and the development of complex codes to evaluate the plasma sheaths that surround satellites. The results of these theories and calculations have wide application in space physics in the design of systems and in the interpretation of low energy plasma measurements.

In this review, those aspects of charge buildup on satellite surfaces relevant to the space physics community are summarized. The types of charging processes, models of charge buildup, satellite sheath theories, and charging observations are described with emphasis on basic concepts. (Spacecraft charging, plasma...)
Rev. Geophys. Space Phys., Paper 1R1080